AN INTERIM REPORT ON FLOWS IN THE LOWER ROANOKE RIVER, AND WATER QUALITY AND HYDRODYNAMICS OF ALBEMARLE SOUND, NORTH CAROLINA, OCTOBER 1989-APRIL 1991

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ABSTRACT

A 3-year investigation was begun in 1990 to (1) develop a model for computing flows in the lower 67 miles of the Roanoke River, (2) characterize water-quality conditions in Albemarle Sound, and (3) describe the circulation regime of Albemarle Sound. This report summarizes data and results obtained during the first year of the study.

Water levels in Albemarle Sound may affect flows in the Roanoke River as far upstream as Hamilton, North Carolina, 59 miles upstream from the sound. Water levels in the lower 20 miles of the Roanoke fluctuate in response to water levels in Albemarle Sound even during periods of high inflow. Moreover, the presence of higher water levels downstream relative to those upstream indicates that reverse flows likely occurred in the Roanoke River downstream from Jamesville in October and December 1990.

A one-dimensional, unsteady flow model has been implemented to compute flows in the Roanoke River between the State Highway 11-42 bridge and Jamesville. The model presently (1991) is calibrated and validated for the reach of the Roanoke between the State Highway 11-42 bridge and Williamston. For the calibrated model, simulated and observed water levels at Hamilton typically differed by less than 0.5 foot. The difference between observed and simulated depth of flow was less than 5 percent at high water levels. Based on a comparison of simulated flows with 33 discharge measurements, simulated flows generally were within 10 percent of observed values. Actual flow measurements, which are used to develop stage-discharge ratings, are considered to have an accuracy of no better than 5 percent. Hence, these flow simulations have nearly the accuracy of discharges computed from stage-discharge relations in other streams.

Near-surface and near-bottom specific conductance, near-surface water temperature, and near-surface, mid-depth, and near-bottom dissolved-oxygen concentrations are monitored at 15-minute intervals at 10 locations in Albemarle Sound. Salinity values calculated from observed specific conductance ranged from essentially 0 to more than 9 parts per thousand, and the observed daily range (difference between daily maximum and minimum values) of salinity at each site generally was less than 1 part per thousand. The observed annual variation in water temperature was more than 30 degrees Celsius; diurnal temperature fluctuations were about 1.3 degrees Celsius. Dissolved-oxygen concentrations ranged from supersaturated to hypoxic conditions. The daily range in dissolved oxygen typically was larger during the summer months than during the rest of the year.